KOMMOS AND A GREAT MINOAN TRIANGLE: RETHINKING THE EARLY – MIDDLE MINOAN POLITICAL AND ECONOMIC LANDSCAPE OF SOUTH-CENTRAL CRETE

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ABSTRACT

This thesis seeks to examine the characteristics, theoretical origins, and utility of a political network in south-central Crete known as a "Great Minoan Triangle." The theory, first published in 1985, concerns the political and economic relationships between the three largest known sites in the region: Phaistos, Agia Triada, and Kommos. The Triangle system proposes a mutually beneficial relationship between the three sites throughout the entire Minoan period, and perhaps even earlier. However, definitive attributes of the Triangle are scarce, which complicates its application to an understanding of the Early and Middle Minoan periods. This thesis examines the Triangle through the consideration of contemporary theoretical approaches to systems modeling during the 1960s–1980s, to evaluate the scholarly framework out of which the system emerged. A comprehensive analysis of the Triangle and its nuances allows for the rethinking of the theory as a whole, through the lens of recent studies in spatial technologies.

BIOGRAPHICAL SKETCH

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PREFACE

This study seeks to examine the characteristics, theoretical origins, and functional utility of a proposed political network in south-central Crete known as a "Great Minoan Triangle." Stretching between the sites of Kommos, Phaistos, and Agia Triada, the Triangle is proposed to encompass the political and economic activities of the three sites during the Minoan Period. The three sites in question are presently the largest known sites in the region, known as the Mesara plain, which renders the theory significant within the broader history of Minoan Crete. The theory of the Triangle proposes a mutually beneficial relationship between the sites throughout the entire Minoan period, and perhaps even earlier. The theory itself is complicated by a relative scarcity of definite attributes assigned to the system, and a lack of an underlying theoretical foundation. This prompts an examination of contemporary and similar theoretical approaches to systems modeling during the span of the 1960s–1980s, the era during which the Triangle system originates. A deep understanding of the state of the field during this time period meaningfully impacts both an appreciation of the Triangle system, in addition to the validity of its application to Minoan Crete. From this, it is possible to begin to rethink the political landscape of south-central Crete during the EM–MM periods, through the use of recent studies in Geographic Information Systems (GIS).

The first systematic excavations at Phaistos and Agia Triada began in the first decade of the 20th century (Watrous et al. 2004: 3), whereas excavations at Kommos began 70 years later (Shaw 2006b: 12). Due expressly to significant variation between archaeological methods, technology, and publication of results, it is not presently possible to commence a direct comparison between the material records of the three sites of the Triangle. To mitigate this incompatibility requires an alternate means of evaluation, and thus GIS is here forwarded as a solution.

CHAPTER 1

A GREAT MINOAN TRIANGLE IN THE WESTERN MESARA

The site of Kommos is located in south-central Crete, situated on the coast of the western Mesara Plain (Figure 1). The site first appears in the literary record in a 1924 publication by Sir Arthur Evans, and though several archaeologists and travelers alike visited the site following Evans's description of "Komo," none broke ground until Joseph Shaw in 1976 (Shaw and Shaw 1995: 9–11; Shaw 2006b: 12). Under the auspices of the American School of Classical Studies at Athens, and in association with the University of Toronto, excavations were conducted from 1976–1990 under the direction of Joseph and Maria Shaw (see Shaw and Shaw 1995).

As a whole, Kommos features a Minoan settlement, dated to Middle Minoan IB - Late Minoan IIIB, as well as later monumental buildings, in addition to a Greek sanctuary (Figure 2). The principal investigators indicate that Kommos would have been a favorable location to found a town, as its coastal location provided shelter from storms and high winds by both a nearby natural inlet and the hillsides upon which the settlement was founded. Finally, inhabitants of the town would have had access to fresh water from a nearby spring, crucial to both the population of the settlement and their agricultural activities (Shaw 2002: 100; Betancourt 1985: 1; see Siart et al. 2013: 75). The site is the only fully excavated and published Minoan coastal settlement in south-central Crete to date.

Between the late Early Minoan (EM) to the Middle Minoan IA (MM IA) periods, the site was sporadically inhabited (Betancourt 1990, 25-28; 57-64). However, following the MM IB phase, a dramatic increase of ceramic evidence has been recovered in the northern area of the settlement (Van de Moortel 2006: 319). Aleydis Van de Moortel concludes that "the population of Kommos was, from the beginning, substantial and did not significantly increase during the Protopalatial period" (Van de Moortel 2007: 179). Van de Moortel focuses particularly on the significant increase in ceramic remains over a short period of time, and maintains that Kommos "burst onto the scene" due to its status as an "implant" under the direction of the nearby

"Phaistian elite." That is, Van de Moortel associates the rapid growth of Kommos following the MM IB period with construction of the palace at Phaistos, and from that, potential growth in power or authority of a Phaistian elite (Van de Moortel 2007: 179). However, Van de Moortel herself recognizes that the dearth of evidence during the pre-MM IB period renders it circumstantial at best. Nonetheless, a belief in the jurisdiction of Phaistos over Kommos appears often in late 20th-century scholarship concerning south-central Minoan Crete. When Shaw and his team began their work at Kommos, he indicated that they "were therefore particularly interested in discovering whether the Minoan remains were sufficient to designate a second major Minoan site in the Phaistian sphere of influence," (Shaw 1984: 24) the first being Agia Triada. Philip Betancourt maintains that "other sites with important histories at this time surely owed their prosperity to decisions made at Phaistos, decisions that distinguished one site from another for Phaistian-centred reasons" (Betancourt 1985: 1). L. Vance Watrous, at the outset of an extensive survey of the Mesara plain which began during the mid-1980s, stated that "The Western Mesara was an ideal area for the project because it formed the heartland of the territory controlled by the city of Phaistos ca. 1900–150 BC" (Watrous et al. 1993: 193). It is evident that contemporary theory supported the belief that the palatial site of Phaistos presided in some capacity, due to its proximity and synchrony, over the Kommos settlement.

On December 29, 1984, a conference was held at the University of Toronto entitled "A Great Minoan Triangle in Southcentral Crete: Kommos, Hagia Triadha, Phaistos." After nearly a decade of excavations, Joseph Shaw endeavored to "examine the dynamics of interrelationships in a single geographical area," and utilized the Western Mesara as a case study (Shaw 1985a: 1). The conference resulted in the emergence of a theory concerning the existence of a "triangle" between the three known major sites in the Western Mesara, as given in the title of the event. The conference proceedings, published in 1985, identified Kommos's "role as a harbourtown…in the context of its relations with neighbouiring [sic] Minoan sites" (Shaw 1985a: 1). However, the publication as a whole does not include a definition of the proposed Great Minoan Triangle system. The majority of the evidence for the Triangle itself can be found

in the discussion sections which follow the individual articles in the printed volume. Ultimately, it can be understood that the proposed Triangle system concerns only the sites of Kommos, Agia Triada, and Phaistos; Joseph Shaw suggests that the three sites were involved in a type of mutually beneficial relationship, with the seat of power located at either Phaistos or Agia Triada, or both (Shaw 2002: 108–109). In this system, Kommos would have acted as a harbor site "which fed the nearby urban centre" (Watrous 1985: 7). It then seems that Kommos would have provided a variety of maritime resources, due to its advantageous location on the coast, though the nature of these resources is unclear. The site is interpreted as "a town which would serve ships: fishing ships; ships which would go beyond the islands; and to the East and to the West; serving a number of purposes" (Shaw 1985b: 35). No additional attributes of the system are indicated.

The lack of a clear definition of the proposed Minoan Triangle between Kommos, Agia Triada, and Phaistos within the 1985 text clouds an understanding of the relationships between the three sites. Though the stated goal of the conference was to "serve to inform our own future efforts to interpret the remains at Kommos" (Shaw 1985a: 1), the 1985 publication on the Triangle does not make reference to specific material evidence which would support the existence of the system as a whole. Additionally, the contributors to the conference do not provide a distinct chronology of the proposed Triangle system. Rather, the Minoan Triangle is presented as a diachronic relationship between three nodes of settlement which arose from the Mesara plain and presumably grew over several centuries. No date, time period, or era is supplied for the emergence of the Triangle in the conference proceedings. It is difficult, then, to functionally employ the Triangle theory in any effort to "interpret" the remains at Kommos solely from this initial publication.

Following the 1985 conference publication, the Triangle is scarcely discussed in published literature. This may lead to the perception that the theory of the Triangle was not accepted, or

had been revised in the following years. However, the theory resurfaces in two recent sources, presented as an established, active political system in the Minoan Mesara landscape. First, the Triangle is referenced in Volume V of the Kommos publications (see Shaw and Shaw 2006), in Joseph Shaw's conclusions concerning Kommos's place in the broader Mesara landscape. Shaw presents a lengthy table (see Figure 3) which diachronically compares material evidence from the three sites in the Triangle, though he acknowledges that "it is beyond our purpose here to provide full explanations and documentation for all aspects" of the data (Shaw 2006a: 865). The material corpus presented is largely ceramic in nature, alongside related architectural remains. Shaw presents the data table in the hopes that its diachronic nature may reveal potential shifts in power along the nodes and lines of the Triangle, alongside consideration of Knossian influence in the Mesara across several hundred years of Minoan history (Shaw 2006a: 865). The second and final discussion of the Minoan Triangle can be found in Joseph Shaw's Kommos: a Minoan harbor town and Greek sanctuary in southern Crete (2006), which is the most recent, comprehensive publication of the Kommos site to date. The publication provides a brief summary of the Minoan Triangle system, in an effort to contextualize Kommos within south-central Crete during the Minoan period (Shaw 2006b: 79–81). In this concise section, Shaw concentrates on the "relative pottery sequence" between the three sites of the Triangle, and additionally in comparison with the Minoan pottery sequence as established by Sir Arthur Evans in north-central Crete (Shaw 2006b: 80). The only update to the Triangle system is a refinement of the MM III – LM I ceramic chronology of the Mesara plain. Neither additional material evidence for the Triangle nor a comprehensive definition of the Triangle is given. Shaw does make reference to the Kommos diachronic data table, mentioned above, and maintains that due to the creation of the table, "the dynamics of relative growth and decline can now be investigated for various periods

over some eighteen hundred years of history" (Shaw 2006b: 80–81).

This summary is supplemented by an illustration of the south-central Mesara plain overlaid by a straight-edge, scalene triangle, which connects the sites of Kommos, Phaistos, and Agia Triada (Figure 4). The placement of the image in the volume encourages an impression that the political, economic, and social connections of Kommos, Agia Triada, and Phaistos operated approximately on the lines drawn on the map. It is additionally not difficult to see how this geometric network would fit neatly into the "carved" landscape typical of early models of Minoan political history (Schoep and Tomkins 2012: 5). Additionally, the image is not accompanied by discussion or an indication of chronology. Indeed, all publications which include a discussion of the Great Minoan Triangle lack references to distinct time periods during which the system may have materialized. However, within the first few pages of the recent 2006 comprehensive publication on Kommos, Joseph Shaw presents a copy of Sir Arthur Evans's original chronology (Shaw 2006b: 6; see Table 1). No other additional chronology is presented or referred to, which leads the reader to conclude that this version is what is used in the interpretation of the history of Kommos. To use Evans's original chronology must be a deliberate choice, as it has been significantly modified and updated over the past century (see discussion in Manning 2010). However, neither the decision to employ this chronology nor any implications of doing so are addressed by Shaw.

As discussed above, scholarship concerning the Great Minoan Triangle does not reference specific material evidence which might substantiate the existence of the relationship. Indeed, a survey of all published evidence across the Kommos volumes reveals a lack of distinguishable material evidence which clearly links the sites of Kommos, Phaistos, and Agia Triada together prior to the Neopalatial period (MMIIIA). It is then surprising that the data table discussed above

begins as far back as the Final Neolithic period, as if suggesting a relationship between the sites before the Minoan period. However, it is possible that the authors of the theory use the affluence of Kommos during the Neopalatial period onwards as a starting point for interpreting earlier periods. That is, that material evidence from later periods is used to substantiate an assured period of earlier growth, which gradually increased in the interim. A prime example is found in the analysis of the ceramic record of Kommos during the Minoan period. Large quantities of identifiably imported pottery, excavated from secure contexts, have been dated to the Late Minoan period at the site (Watrous 1992: 149–69). However, the securely recovered, identifiably foreign sherds for the entirety of the Early Minoan and Middle Minoan periods at Kommos number only 11 (see Table 2). These sherds originate from the Greek mainland, Aegina, the Cyclades, Cyprus, and three are of unknown provenance (Betancourt 1990: 191–192). Philip P. Betancourt, in his analysis of these sherds, maintains that the group "show[s] that the dynamic foreign contacts that would be so important at Kommos in Late Minoan were already becoming established in the early periods" (Betancourt 1990: 191). However, it is implausible that such a small group of sherds, lacking both complete vessels and identifiable similarities in type or use, could definitively substantiate the growth of later, large-scale economic and political contact, even allowing for decay of the material record over time. Rather, this analysis is a retrojection of evidence of the LM period into the distant past. This action plants the seeds for systems and institutions which would come to fruition several hundred years later.

This use of retrojection imparts a sense of consistency and continuity within the economic, social, and political realms of Minoan Kommos. Kommos during the Early and Middle Minoan periods, as a member of this Great Minoan Triangle, is portrayed as an early, growing hub of international contacts and trade, which as a tangible community exploited its

unique, natural position on the coast (see Shaw 2002: 104). Betancourt's ceramic analysis implies that the inhabitants of Kommos had begun not only to actively and consciously interact with several international groups and cultures within the EM and MM periods, but that they had instigated the creation of a distinct socioeconomic system which would be steadily grown and maintained for centuries. Despite a relative paucity of material evidence, the early history of the site is thus transformed into a communal landscape of social and economic success. From this, Kommos would have been a valuable member of the Great Minoan Triangle, subordinate to the palatial center of Phaistos. With an appreciation of the relative absence of a material record to support the Great Minoan Triangle system, one must turn to theoretical approaches to evaluate the functional utility of the system itself.

CHAPTER 2

20TH CENTURY APPROACHES TO THE POLITICAL AND ECONOMIC LANDSCAPE OF MINOAN CRETE

As noted above, Joseph Shaw chooses to utilize Sir Arthur Evans's original 1906 chronology in the most recent, authoritative publication on the site of Kommos (Shaw 2006b). This choice is made despite a significant body of modern research which has since refined the original chronology. As this is the same publication which presents the Great Minoan Triangle as an assured element of the political and economic landscape of Minoan Crete, the employment of Evans's chronology is significant in a study of the Triangle as a whole. It then becomes necessary to examine Evans's chronology as a discrete entity to discover the additional impact of the chronology's use, in an examination of the political and economic landscape of Minoan Crete.

Following Sir Arthur Evans's initial excavations at Knossos, he constructed a chronology of Minoan history (Evans 1906: 4). In his chronology, Evans relied primarily on perceived change in the complexity of decoration of ceramic materials to define periods of Minoan history. He viewed Minoan art as a whole as a type of "biological metaphor" for youth, maturity, and old age, which directly mapped to the Early, Middle, and Late Minoan periods (McNeal 1973: 209, 216-217; see Evans 1906: 4). In effect, Evans's chronology entrenched Minoan history in "a larger Darwinian tale of universal progress" (McEnroe 2010: 6). The chronological divisions which were then applied to sites and artifacts across Crete were thus "not a neutral sequence of dates, but a narrative with a story line that emphasized development, maturity, and decline" (McEnroe 2010: 6). The climax of this narrative was placed at the end of the Middle Minoan period and the beginning of the Late Minoan period, when "the Second Palace at Knossos

became the grandest monument in the history of Minoan Crete" (McEnroe 2010: 69). The very chronology of Minoan Crete, as constructed by Evans, thus privileged the gradual growth and expansion of these monumental constructions in the treatment of time itself.

Looking backward, it then follows that the roots of the later "maturity" of the palaces must necessarily be sunk in the Early Minoan Period, which lends itself to its definition as a period of "development." This concept can be found in scholarship through the end of the 20th century: "since the 1960's [sic], a flood of papers and several books have explored the idea that very many aspects of palatial civilization can already be detected in embryonic form in the third millennium and that the evolution of complexity can be 'explained' by tracing these developments over time" (Cherry 1983: 35). Keith Branigan, in his *Pre-Palatial: The Foundation of Palatial Crete, A survey of Crete in the Early Bronze Age* (1988), readily admits that "the Early Minoan I period still remains in the shadows, its details hard to define and its outline rather indistinct." However, he still traces the beginning of a great amount of later developments to this early period, including "the proliferation of specialized industries- metal–working, pottery manufacture, [and] carpentry," as well as overseas trade, ceramic formation techniques, burial practices, and even societal unit distinction (Branigan 1988: 202). Eventually, Branigan states that "palatial civilization must be seen to have its roots in Early Minoan Crete" itself (Branigan 1988: 204). In contrast, John Cherry maintains that early evidence "was scrutinized—some might say, cherry-picked—to find examples of the institutions, architecture, economic structures, and social differentiation characteristic of the palatial era existing in 'embryonic' form centuries later" (Cherry 2010: 110). Cherry additionally denies the existence of significant international relations between Crete and the Aegean during the Early Minoan Period, revealing that for the entire interval, there existed secure evidence of an "exchange of

only about 0.5 objects annually from the entire Aegean over the six centuries in question– a period during which most scholars imagine a vigorous trade in a wide variety of materials taking place throughout the entire Eastern Mediterranean" (Cherry 2010: 112, with references).

Taken as a whole, the active retrojection of LM characteristics into the far-off EM past assuredly constricts the material record of the EM to one known outcome: the eventual rise of the palaces. The implications of this action are manifold, particularly in an examination of the political landscape of Minoan Crete. As the palaces have long been considered the apex of Minoan society, it is no surprise that the structures, along with the individuals who are believed to have controlled the buildings themselves, have been granted significant agency in Minoan history. Indeed, traditional perspectives on the role of the palaces in the political landscape place the monumental structures, and their assumed elite inhabitants, at the top of a political hierarchy. Evans himself maintained that the palaces were the seat of "priest-kings" (Niemeier 1988). Subsequent scholarship maintained that the large-scale, court-centered buildings accommodated "the central seat of a political and religious authority," which prevailed as "the driving economic force in society" (see discussion in Schoep 2006: 38). Within these hierarchies, power and influence would have emanated from their central courts outwards to surrounding settlements, whose inhabitants are assumed to have reflected this hierarchy in their material culture (see Knappett 2012: 385, Branigan 2002: 41-2, and Bevan 2010: 28). The elites who dominated the hierarchy thus controlled the management of the palaces and their associated resources, and in turn directed contemporary society and economic systems (Schoep 2006: 37). Traditional models of Minoan politics additionally emphasized the palaces as redistributive centers which controlled the production and distribution of agricultural and elite objects within a delineated region (see discussion in Nakassis et al. 2010: 244). Such models resulted in the development of "a static

view with the island carved up into large, evenly-spaced and similarly sized territories" of determinate size (Schoep and Tomkins 2012: 5).

Evans's chronology and its associated implications, as discussed above, when combined with this "static view" of Crete as a whole, yields a vision of a highly regular and conforming Minoan society. That is, the social, economic, and political environments of Crete transform into a unified, regular pattern of growth from the earliest periods, which together evenly blossom into the "palatial civilization" during later periods. This generates the perception of a topography of compliance, in which all "territories" across the island, from their very emergence, consistently and purposefully sustain the prevailing politics which the palaces employ. This then hinges on the undeviating position of the palaces, and the individuals who controlled them, at the top of political hierarchies across Crete. This highly-regular landscape is the ultimate triumph of Evans's "Darwinian tale of universal progress" for a narrative of the political landscape of Minoan Crete. The palaces and their associated administrators are bolstered not only from the complete compliance of the settlements over which they preside, but additionally by the assured trajectory of growth assigned to them by Evans's chronology.

Evans's chronology is thus a foundational concept in the history of politics in the Minoan Mesara. The nuances of the chronology – the "narration" of steady growth over time, focus on hierarchy and the palaces, and the creation of highly regular territories across the political landscape – map directly onto the characteristics of the Great Minoan Triangle system as a whole. However, rather than identifying only the foundational impact that the work of Sir Arthur Evans has had on the Triangle, it is fruitful to identify similar theoretical approaches within scholarship contemporaneous to the Triangle theory's inception. An understanding the state of the contemporary field, and trends in archaeological analysis, can lead to a deeper appreciation

of the generation of the Triangle system and aspects of the proposed system itself. Despite the general scarcity of overtly stated characteristics of the Triangle, there are a few definitive attributes (as discussed above). First, the assured centrality of Phaistos in Kommos's history (Shaw 1984; Betancourt 1985; Shaw 2002); second, Kommos's role as an active harbortown hosting ships from abroad (Shaw 1985a; Shaw 1985b; Watrous 1985); third, the geometric configuration of the Triangle itself (Shaw 2006b). The foundational evidence for the second attribute has been discussed at length above. However, the analysis of the first and third key features of the Kommos site, through the lens of scholarship contemporaneous to the genesis of the theory, significantly impacts the application of the theory to the Minoan political landscape.

To begin, Henry T. Wright, in 1977, examines several contemporary theories of state origin and development. Though each approach incorporates different state-level activities, application of force or conflict, differential administrative needs, etc, Wright identifies a few general similarities between several recent theories of state genesis, with a broad geographic scope. The very first conclusion maintains that "States are variously defined as either a kind of government (that is, specialized and hierarchical), or a kind of society with such a government" (Wright 1977: 218, with references). Similarly, Colin Renfrew, in 1974, indicates that "human society is often hierarchical in nature" and maintains that development of polities occurs when "a number of basic cells" combine to form a new, "higher organisation to deal with the consequences of union, while retaining elements of the former cellular pattern" (Renfrew 1977: 104). The form of the Triangle, with Phaistos placed at the top, nestles quite easily between these two conclusions. As these two interpretations by Wright and Renfrew are grounded in a consideration of the general condition of state formation theory in the 1970s, the concept of hierarchy seems then to have been essential to the scholarship of the time.

An additional appearance of hierarchy in contemporary scholarship can be found within central place theory and its successive expansions during the 1960s–1970s. In its most basic form, under ideal conditions, the theory maintains that "demand for goods and services will be met by settlements spaced at regular intervals over a triangular grid" (Wagstaff and Cherry 1982: 246; see Christaller 1966). Malcolm Wagstaff and John F. Cherry, in their discussion of central place theory models with relation to Melos, indicate that while the settlements may provide products to each other, a hierarchy does develop between the main, higher order site, and the lower order sites which form the base of the triangular structure (Wagstaff and Cherry 1982: 246). More complex models of central place theory address issues and needs of multi-faceted relationships between several sites, which result in multiple snowflake-like lattice diagrams (Figure 5). As a foundational concept in all forms, the lower order sites would necessarily be located on or near the most optimal locations to access the resources which would be desired and summarily controlled by the higher order site. "Effective activity coordination has been identified as the basis for the hierarchical structure of decision-making or administrative organizations" for over half a century (Johnson 1977: 493 with references). Applying the central theory approach and its hierarchy to the Great Minoan Triangle, Phaistos would serve as the higher order, central site, benefitting from resources available at Kommos and Agia Triada, through MM IIIA (see discussion in La Rosa 2010: 584–590). Kommos's position would then be easily exploitable for marine resources, in some form, which would be transported in some way to Phaistos (see Van de Moortel 2007: 178–9). Though the employment of central place theory is not explicitly stated in the Great Minoan Triangle literature, the resemblance of the two approaches adds greater depth to the initial assertion that Kommos would have, in the Triangle, acted as a harbor site "which fed the nearby urban centre" of Phaistos (Watrous 1985: 7).

The geometric shape of central place theory is not unique to scholarship during the 1960s–1980s. Simultaneous to the appearance of the lattices of central place theory is the application of hexagonal site organization to the ancient landscape. The vision of hexagonal structural forms across a political landscape first appeared in earlier 20th century literature, and requires strict uniformity in all aspects administrative, economic, and often ceremonial (see discussion in Flannery 1972: 418). However, Gregory Johnson's application of the hexagonal model to the landscape of Mesopotamia in 1972 marks one of the first implementations of this approach to an ancient civilization (Johnson 1972). His work yielded an image of prehistoric Mesopotamia covered in triangles, hexagons, and rhombuses (Figure 6), which represented a framework of regional interaction between settlements of various sizes. Here the Great Minoan Triangle could serve as a geometric piece of a larger landscape puzzle. However, the hexagonal approach is criticized for being static; it fails to represent more than a single moment in time (Renfrew and Level 1979: 147; Johnson 1977: 495–6). Though the graphic representation of a broad landscape, covered in geometric forms, may initially seem authoritative, the theory's weakness is the inability to account for progress over time– just the same as the Great Minoan Triangle. The rigidity of the static hexagonal approach additionally renders the model unable to adjust for the possibility of an intermittent settlement pattern in a given society (see Johnson 1977: 495 with references). This necessarily complicates an application of the full hexagon approach to the Minoan Mesara, particularly due to several destructive events identified in the material record at several sites (Shaw 2006a: 865).

In the absence of a core explication of the Great Minoan Triangle theory, as well as a scarcity of secure material evidence to substantiate the system, comparison between contemporary models is invaluable. Central place theory and the similar hexagon model

correspond to several facets of the Great Minoan Triangle: its triangular shape; its ability to exploit its natural position and resources; the assumed dominance of Phaistos at the top of a hierarchy; its lack of a temporal aspect. However, the remaining issue not yet addressed is the model of a closed system surrounded by a barren hinterland. It is understood that "the state cannot be studied as a freestanding entity in splendid isolation from society at large, particularly since state boundaries are not easily drawn" (Nakassis et al. 2010: 247). The Triangle system hyperfocuses on the three nodes with few exceptions (Figure 3), which yields the vision of a topography empty of all but the three key sites (Figure 4). The vacancy of the surrounding Cretan landscape defines the Great Minoan Triangle system just as much as its straight-edge lines. A remarkable correspondence can be found in Colin Renfrew and Eric V. Level's 1979 XTENT model, with concern to both the treatment of hinterland and the overall shape of the model itself (Figure 7; see Renfrew and Level 1979).

Renfrew and Level's triangular model is based on several mathematical equations, used in conjunction with a computer program written in FORTRAN, run on a PDP 11/45; these technical specifications prevent straightforward, modern replication of the process. At its core, the model assumes that the influence of a given central settlement is directly related to its size, and this influence measurably declines linearly with distance. The rate of decline, or slope of the triangle form, is not assumed, and it is certainly possible for two triangular "bell-tent"s to intersect each other at a given point, indicating an overlap of influence. Of particular relevance is the XTENT model's treatment of all space not encompassed by a bell-tent. If such an area "is not dominated by any center… then it is left politically unassigned: The location is in 'no-man's land'" (Renfrew and Level 1979: 151). The XTENT model "thus allows the creation of hypothetical political maps, using only the location and size of settlements (or other centers) as

input information, and generating political divisions without any prior knowledge of them" (Renfrew and Level 1979: 151).

The significance of the visual form of the XTENT model, in comparison to the Great Minoan Triangle map, cannot be overstated. The XTENT approach, which was published only a handful of years before the theory of the Great Minoan Triangle, specifically allows for the generation of political maps in the deliberate absence of evidence. XTENT creates space for an alternative understanding of the scarcity of overt parameters of the Great Minoan Triangle as a dearth of real evidence. Indeed, the XTENT model indicates that distinct characteristics may not have been needed to effectively construct a potential political structure within a given landscape. The comparison between XTENT's bell-tents bordered by no man's land, and the straight-edge Great Minoan Triangle surrounded by an empty hinterland, forms a juxtaposition crucial to the understanding of the Minoan Mesara. Furthermore, the XTENT model as a whole serves as a keystone to a particular era's approach to systems modeling, during which the Great Minoan Triangle was produced. In this way, the contextualization of the Great Minoan Triangle within this larger body of work enables the appreciation that the Triangle system was certainly a product of its time. It is, to a great extent, a description of potential prehistoric relationships derived from both historic principles of Aegean archaeology and the broader 1960s–1980s theoretical field as a whole. With this crucial understanding, it becomes possible to begin to update and refine the theory of the Great Minoan Triangle, and initiate a reconsideration of potential political, economic, and social networks of EM–MM south-central Crete

CHAPTER 3

GIS APPLICATIONS IN SOUTH-CENTRAL CRETE

The image of the straight-edge triangle, laid over a map of south-central Crete, inspires a discussion concerning the topography of ancient Crete. As previously discussed, the Triangle image itself originates from several contemporaneous approaches to systems modeling. However, it serves as a definitive starting point in thinking through the practicality of travel between the three sites. The relative ease of travel between nodes, and more broadly the state of the physical landscape of ancient Crete, has a significant impact on the practicality and character of the relationships between the three settlements. To pragmatically approach possible routes between the three nodes of the Triangle requires a consideration of the intertwined mechanisms of distance and ordering. Distance itself can be utilized by a given authority as a distinct resource, which could be actively defined, manipulated or controlled (Schoep 2006: 56). In this way, "distance is something that can be defined, mapped, and ordered by a particular authority. Such control is likely to focus on collapsing and reordering distance by importing it into its own locale" (Schoep 2006: 52). In the manipulation of distance as a resource, a given authority is able to institute a topographical strategy of ordering in a direct effort to delineate a given region or area. In this way, a region is no longer defined by what or who it contains, but the precise location and extent of its borders. In the case of the Great Minoan Triangle, the image of the Triangle advances the impression that the authority of the system would have employed border-setting in its self-establishment. Motivated to create a defined political relationship in the Mesara plain, the authority of the Triangle could have undertaken various efforts to establish a distinct, ordered region or political division in the landscape.

To begin to elucidate the realistic experience of movement through the landscape of south-central Crete requires a consideration of recent studies in Geographic Information Systems (GIS). Though GIS systems were not initially designed for archaeological implementation, they offer a host of analytical tools which can be used to analyze ancient landscapes using modern remote sensing technologies and additional environmental data (see Kosiba and Bauer 2012). GIS enables a user to calculate least-cost surfaces, the pathways across a given topography which offer the most cost-effective route between an origin point and a destination point. The determination of least-cost surfaces illuminates potential pathways across a landscape which individuals could have utilized to move between given settlements, with regard to the slope and additional topographical characteristics of the land traversed (Siart et al. 2008; Siart and Eitel 2008; Soetens et al. 2003). The identification of these pathways in a consideration of contemporary political influence is invaluable, as the indicated routes represent "potential past communication paths" through which goods, individuals, and concepts could have transmitted across the physical landscape of Crete (Siart et al. 2008: 2922). The employment of least-cost surfaces assumes that Minoans would generally choose routes with a low cost effort, with the understanding that additional personal motivations may have influenced this choice (Siart et al. 2013: 80; Siart and Eitel 2008: 301). The establishment of least-cost surfaces could then aid the detection of both the material evidence of prehistoric transit as well as presently unknown settlement sites (Siart et al. 2008: 2922; Paliou and Bevan 2016; Siart and Eitel 2008: 300; Siart et al. 2013).

It must be understood that analyses of ancient landscapes are limited by the extent of knowledge concerning the ancient topography itself. It cannot be assumed that modern landscapes are physically and geologically equivalent to their ancient forms. Furthermore,

particularly in the case of Minoan Crete, the archaeological data available for use in GIS investigations are not an indication of a complete material record, but rather a reflection of the results of published surveys and excavations (Soetens et al. 2003: 484). However, recent studies have demonstrated the efficacy of integrating geoscientific methodologies with GIS-based analysis in the reconstruction of ancient landscapes (e.g. Siart et al. 2013; Siart et al. 2008; Soetens et al. 2003; Fernandes et al. 2012). Of particular interest is the Siart et al. 2008 examination and reconstruction of the Bronze Age landscape surrounding the settlement of Zominthos, located in central Crete. The study utilizes an integrative approach to consolidate survey results, remote sensing, digital elevation modeling, least-cost surfaces, candidate site detection, and predictive modeling, alongside several categories of environmental data (Siart et al. 2008). The authors of the geoarchaeological investigation particularly focus on the determination of least-cost surfaces, in an effort to identify both candidate transit roads and settlement sites across the landscape of central Crete. The authors maintain that "potential Minoan transit roads must be seen as a crucial parameter, because they allow the deduction of a proximate set-up of buildings and other infrastructures" (Siart et al. 2008: 2922). Though Siart et al.'s 2008 study focuses specifically on the remote settlement of Zominthos, the authors expanded their investigation of least-cost surfaces across the landscape of central Crete as a whole (Figure 8), which fortunately offers a view of the proposed location of the Great Minoan Triangle.

Though these lines between known and excavated archaeological sites represent the most cost-effective connection between each location, it is understood that efficiency in travel was likely only one of many variables in a contemporary Minoan's choice of travel paths across a landscape. Additional parameters to consider include vegetation, weather, religious or social

constructs, and additional individual or group preferences which may have even outweighed efficiency as a whole. As indicated by the authors of the study, it is of particular interest that these modeled lines roughly match to the predictions given by Sir Arthur Evans in 1929. Evans identified the existence of a "highway" leading from Knossos to Kommos, indicated by the dotted line on the map, on the basis of extensive examination of material remains across the island (see Evans 1929: v). In this way, the GIS-generated least-cost paths through the ancient Minoan landscape are strengthened by an additional dimension of evidence.

Taken as a whole, the model contains remarkable implications concerning the predicted interconnectivity of central Minoan Crete. The model suggests that the sites of Kommos, Agia Triada, and Phaistos are indeed connected in a type of puffy, triangular shape, similar indeed to the shape of the proposed Great Minoan Triangle. However, the model additionally indicates that several settlements across Minoan Crete feature a similar pathway configuration between each respective location. Rather than forming an isolated system between the nodes of a closed, triangular system, Siart et al. 2008's model indicates that the shape of the Kommos-Agia Triada-Phaistos is not a closed system surrounded by barren hinterland, but rather a cluster within a more complex topography. From the least-cost path model, the Great Minoan Triangle may have in fact been one of many clusters across the landscape of central Minoan Crete, both between known and candidate sites. This, in turn, suggests a significantly higher degree of heterogeneity of the landscape of the Mesara plain than previously realized.

In a similar vein, Eleftheria Paliou and Andrew Bevan's recent study of south-central Crete during the Late Prepalatial (EM III–MM I) incorporates a number of computational models in an examination of settlement and spatial patterns with regard to socio-political structure (Paliou and Bevan 2016). Their analyses span several categories of material evidence, including

recovered administrative seals, settlement density modeling, and the incorporation of published survey data. The authors provide a map of known MM IB site distribution across south-central Crete, which have been integrated from numerous surveys (Figure 9; see Paliou and Bevan 2016: 194 with references). In direct comparison to Siart et al. 2008's least-cost path model, it is clear that a number of known, minor sites correspond to the suggested least-cost path between Kommos and Platanos, and even more to the area south of the two sites. Though a comprehensive re-evaluation of least-cost surfaces with consideration of minor sites identified through survey is outside the scope of the present study, it would be a particularly valuable pathway of future research in an investigation of the sociopolitical topography of southernmost MM Crete. However, the most crucial element of the 2016 site distribution model is the significantly greater settlement density than what the Great Minoan Triangle system portrays. This is due predominantly to extensive survey work conducted from the mid-1980s onwards by a number of scholars, which has drastically changed the understanding the Western Mesara as a whole (see Watrous et al. 2004). The dense clustering of minor settlements across south-central Crete contradicts the image of a strictly ordered, rigid political landscape which features only major sites and the sparse hinterland which surrounds them. Rather, these decades of research have remodeled the landscape of MM south-central Crete into a significantly heterogenous topography which contains sites of various magnitudes separated by short distances (see Watrous and Hadzi-Vallianou 2004).

CONCLUSION

This study has sought to establish a deep understanding of the description of the Great Minoan Triangle as presented within the Kommos literature. An examination of numerous theoretical frameworks contemporaneous to the Triangle system are crucial in understanding the nuances of the proposed Triangle itself. First, the juxtaposition of elements of the Triangle with contemporaneous analytical frameworks reveals remarkable similarities between several approaches. This process of in-depth comparison produces the realization that perception of the Triangle system merits a drastic shift. At first glance, it seems as if the Triangle suffers from a scarcity of defined attributes, chronology, and even limited employment in the scholarship of Minoan Crete. However, through an in-depth understanding of contemporary approaches and scholarship, it soon becomes clear that the Triangle itself is a product of the time period during which the theory was generated. In addition, the concept of the Triangle may not have been of enduring utility following its initial proposal, due to extensive survey activity conducted soon after the system's publication (see Watrous et al. 2004).

This shift prompts future research into the establishment of regional political structures during the EM and MM periods in south-central Crete. The present study utilizes recent work in the field of Geographic Information Systems (GIS), to rethink one core aspect of the Great Minoan Triangle system as a whole. However, a comprehensive reconsideration of the Mesara plain region during the EM and MM periods could reveal a much more idiosyncratic material record than previously thought. The sheer amount of recently-recognized candidate sites alone fills up the vacant hinterland that previously characterized the Triangle model. A reassessment of the social, economic, and political landscape of south-central Crete would greatly benefit from the significant advances made in both technology and theoretical frameworks in the over 30

years since the Great Minoan Triangle theory was first published. Future studies concentrating on the social, economic, and political landscape of the Mesara region have the potential to significantly modify the modern understanding of the multi-faceted landscape of south-central Minoan Crete. As the Great Minoan Triangle theory was first published far before the Kommos volumes themselves, future avenues of research on these topics will benefit enormously from the immeasurably valuable and exceptionally abundant scholarship concerning the entire history of Kommos.

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Figure 1, Map of Mesara Plain, from Shaw and Shaw 1995 (frontispiece).

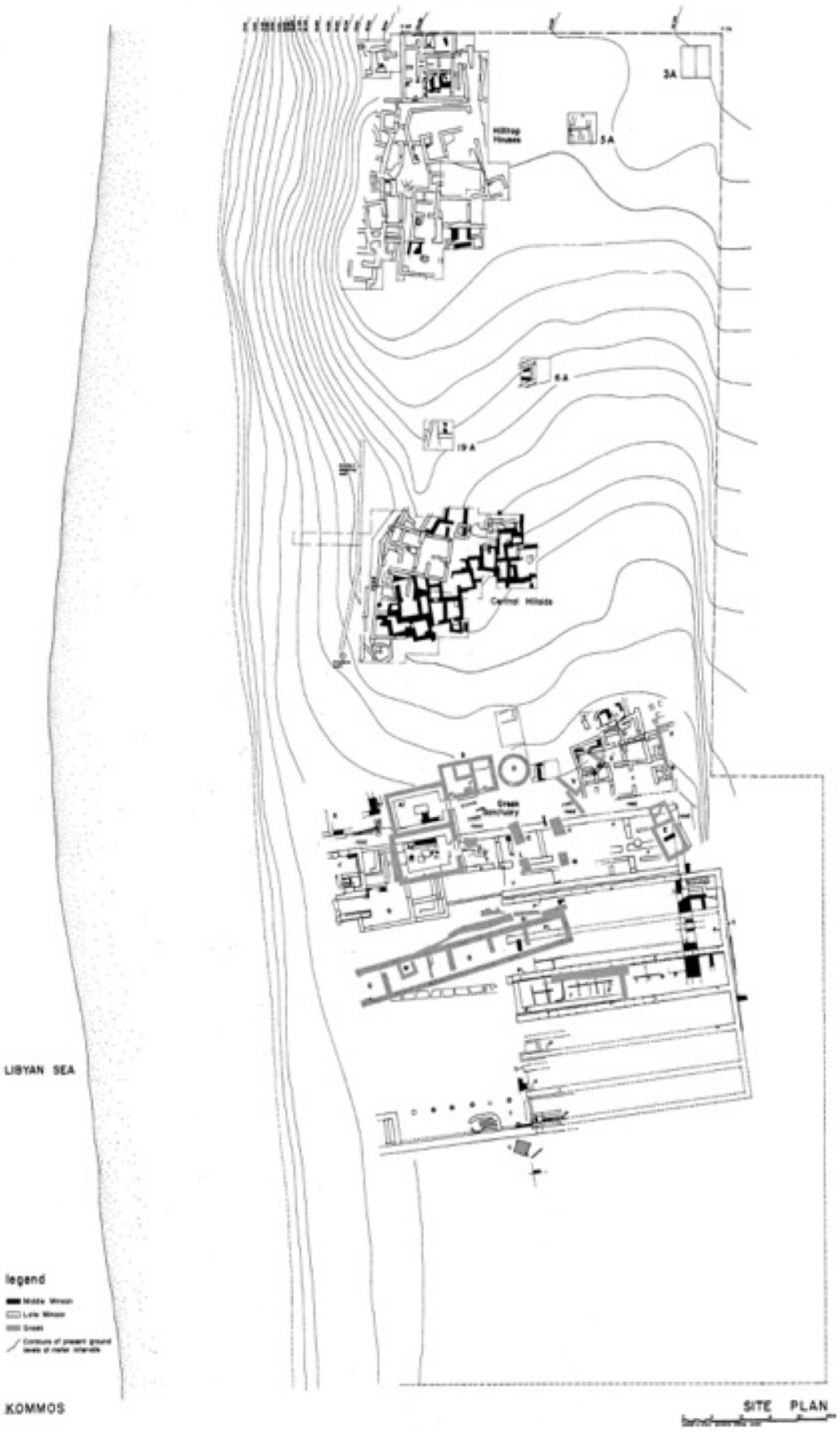

Figure 2, Kommos Site Plan, taken from Shaw and Shaw 1996.

Table 5.1. General historical developments in the western Mesara at the Minoan sites of Aghia Triada, Kommos, and Phaistos: Final Neolithic through Sub-Minoan.

Period	Kommos Southern Area	Kommos Town	Kommos House X	Phaistos	Aghia Triada	Other Sites in Region
FN		Scattered sherds		Acropolis and eastern slopes of the hill (Chalara) settled		
EM I–II	Scattered sherds only; settlement (and cemetery?) located nearby to southeast at Vigles			Acropolis and surroundings settled	Scattered settlement Tholos Tomb A in use (EM IIB)	
EM III				Settlement; early paved walkway	Tholos Tomb A in use	
MM IA				Extensive settlement Early paved walkway reused	Scattered settlement and acme of depositions in Tholos Tomb A Cult area south of Tholos A: baetyls wall	Patrikies Potter's storage site or sanctuary
MM IB	Scattered building; early paved walkway	Dense occupation of Central Hillside, perhaps also of Hilltop		Construction and early use of Old (First) Palace: Levi Phase Ia Houses west of Palace and at Aghia Photini	Possible settlement on the northern and western slopes of the hill Construction of Tholos Tomb B and last use of Tholos Tomb A Continued use of cult area.	Kamilari Tholos Tomb 1 constructed
MM IIA				Extensive settlement Changes in Old Palace structures Levi Phase Ib early (deposits in Bastione II, Vano CVII, etc.)	Possible settlement on the northern and western slopes of the hill Continued use of cult area	

Figure 3, Excerpt from Kommos data table, from Shaw 2006a.

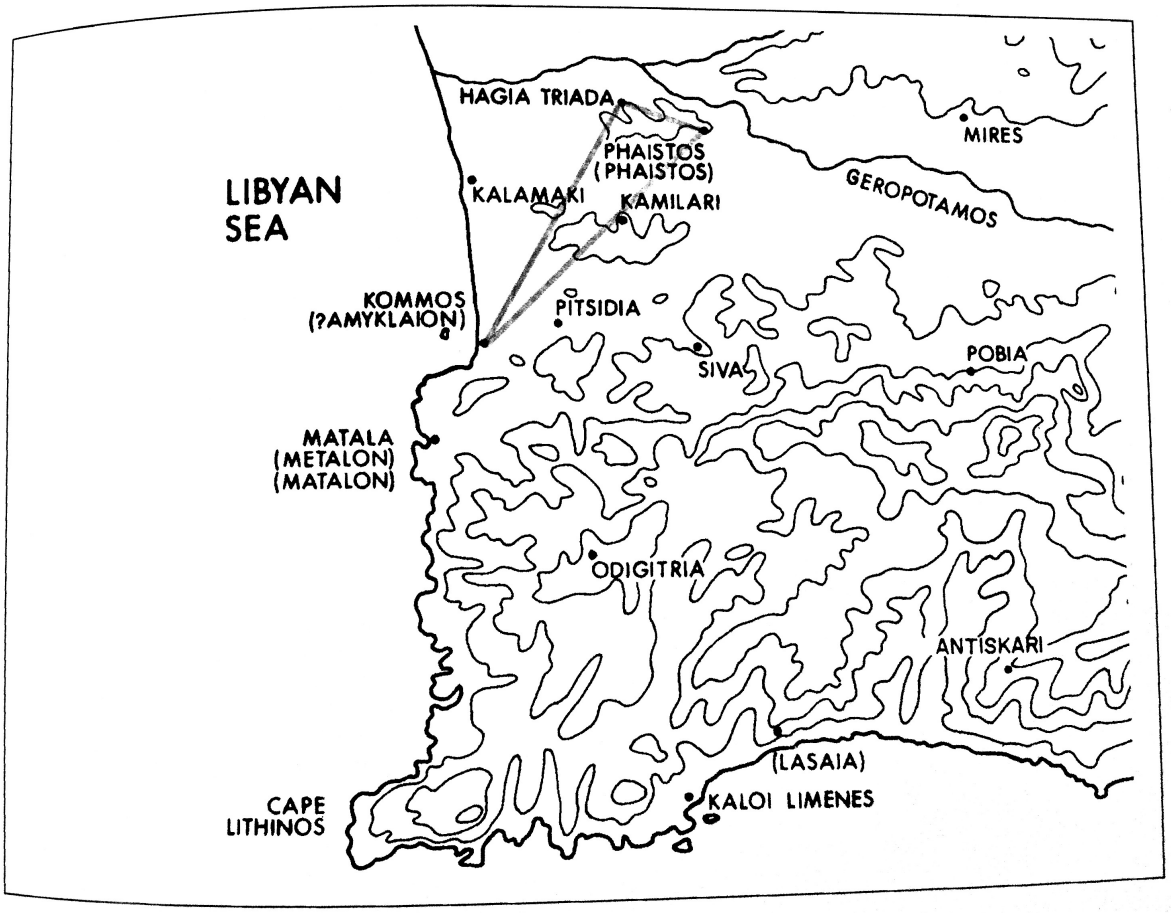

Figure 4, Detail of the "Great Minoan Triangle," from Shaw 2006b.

3500–2000 B.C.	Late Neolithic-Early Minoan Periods.
1900–1700 B.C.	Middle Minoan IB–II Periods.
1700–1425 B.C.	Middle Minoan III–Late Minoan I Periods.
1425–1375 B.C.	Late Minoan II–IIIA1 Periods.
1375–1200 B.C.	Late Minoan IIIA2–IIIB Periods.
1200–1020 B.C.	Late Minoan IIIC–Subminoan Periods.

Table 1, Evansian chronology in use for Minoan periods at Kommos, adapted from Shaw 2006b: 11.

Location	Description	Date
Greek Mainland	(C 4090) Carinated open vessel, rim sherd.	MM III
Aigina	(C 4016) Carinated bowl, non-joining rim and body sherds.	MM IB
Cyclades	(C 181) Jug, body sherd from neck and shoulder.	MM III
Cyclades	(C 3918) Closed vessel, body sherd.	MM III
Cyclades	(C 5768) Jug, body sherd.	MM III
Cyclades	(C 490) Cup, section of rim, with handle.	MM III / early LM IA (?)
Cyprus	(C 6112) Small jug, two thirds complete.	MM III / LM IA (?)
Origin Unknown	(C 4658) Closed vessel, base sherd.	not given
Origin Unknown	(C 2575) Closed vessel, rim sherd.	not given
Origin Unknown	(C 4091) Bowl or basin, rim sherd.	not given

Table 2, Middle Bronze Age Imported Sherds from Kommos, adapted from Betancourt 1990: 191–2.

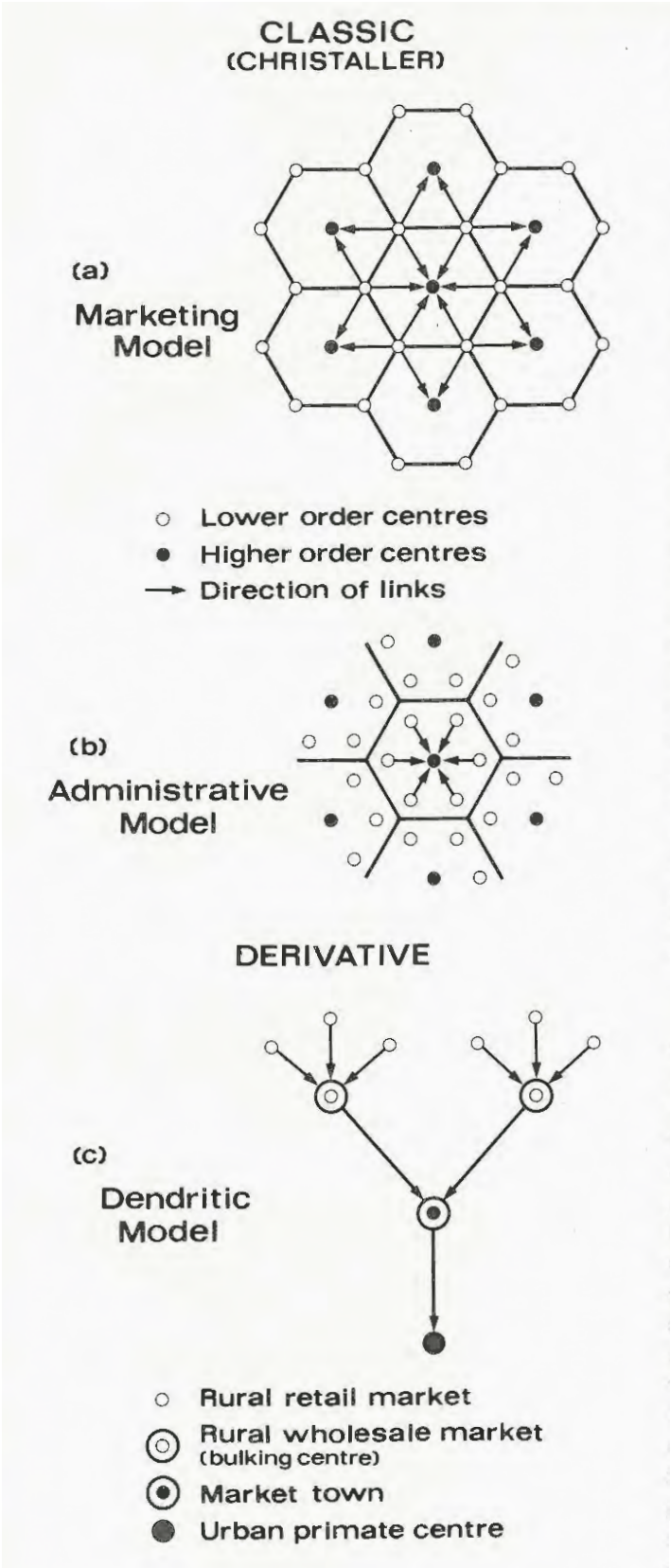

Figure 5, Central Place Theory visualizations, from Wagstaff and Cherry 1982: 247.

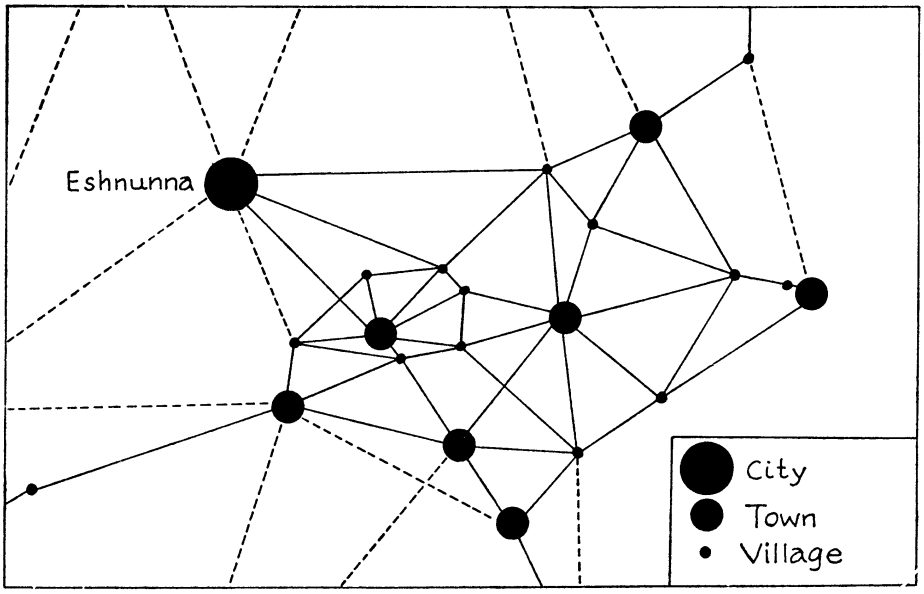

Figure 6, Application of Hexagonal Approach to Mesopotamian Landscape adapted from Johnson 1972, from Flannery 1972: 419.

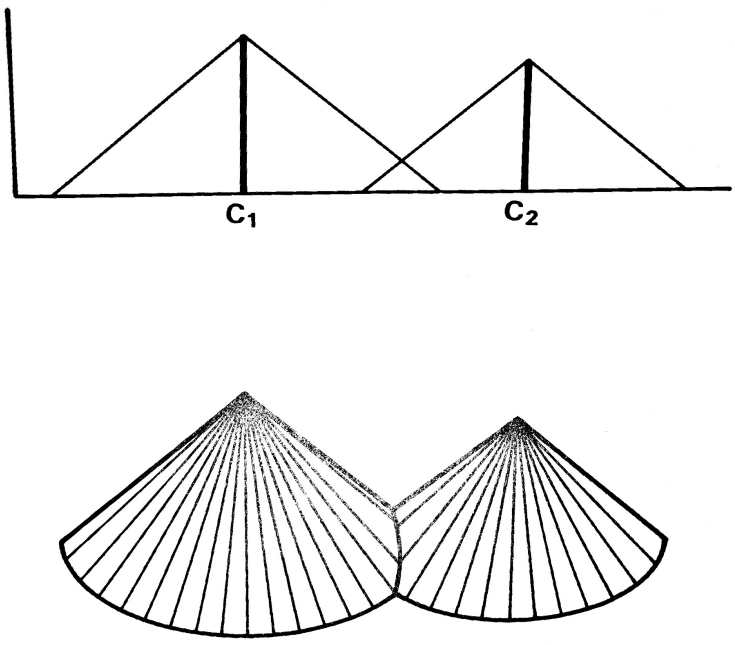

Figure 7, XTENT visual model and "bell-tent" representation, from Renfrew and Level 1979: 150.

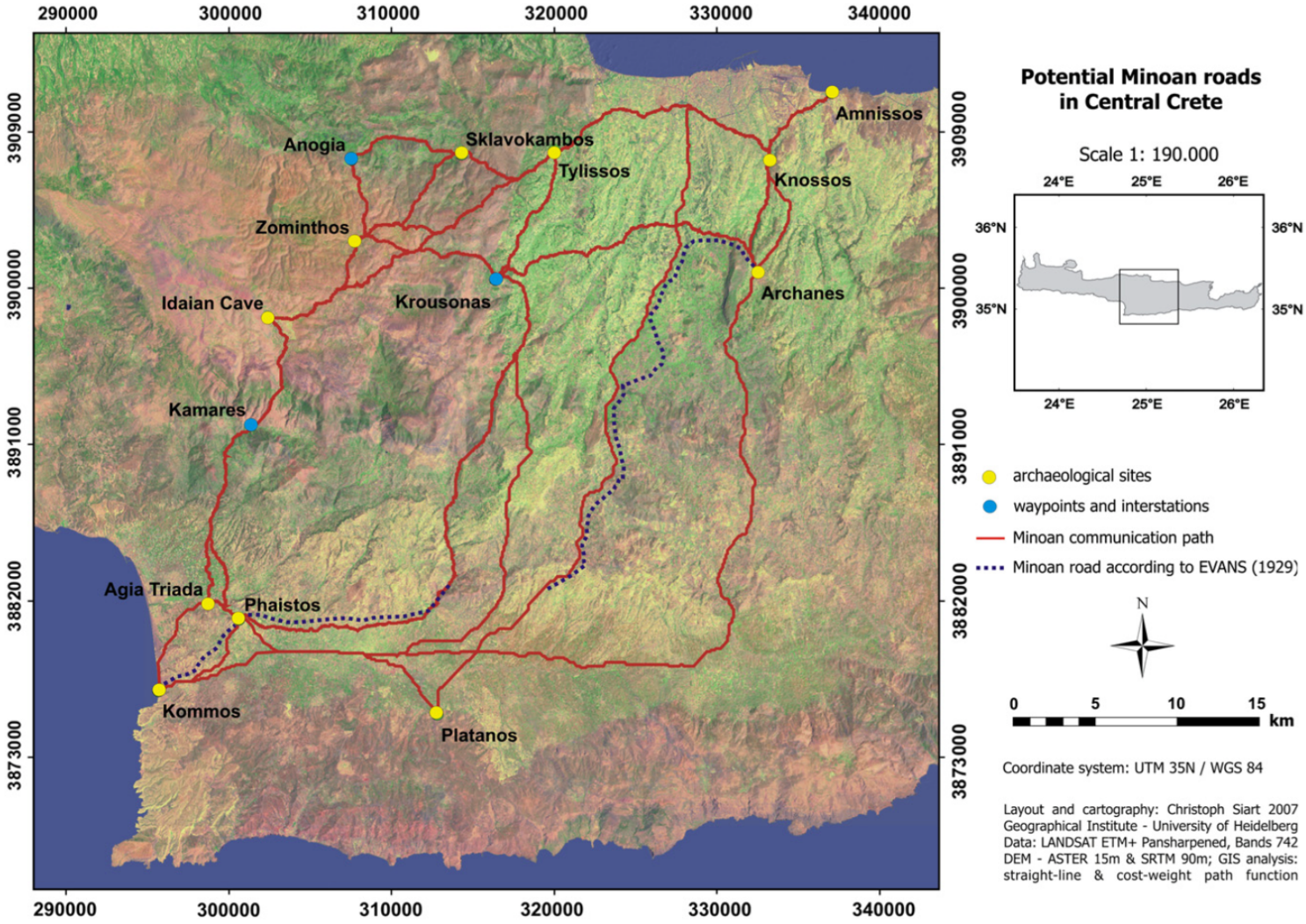

Figure 8, Potential Minoan roads in Central Crete, from Siart et al. 2008: 2923.

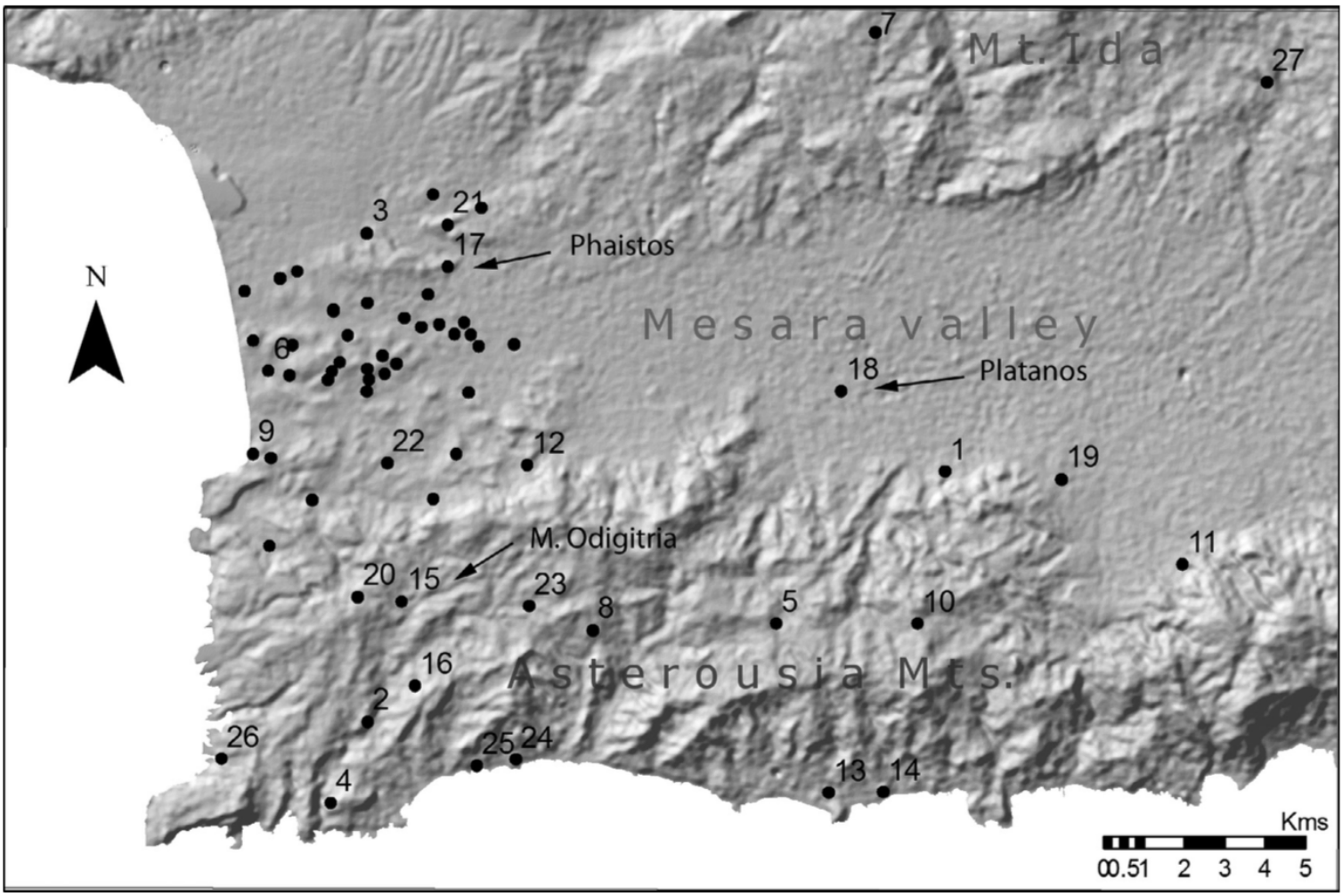

Figure 9, MM IB site distribution, including (unnumbered) sites identified in the west Mesara and Kommos surveys, from Paliou and Bevan 2016: 194.